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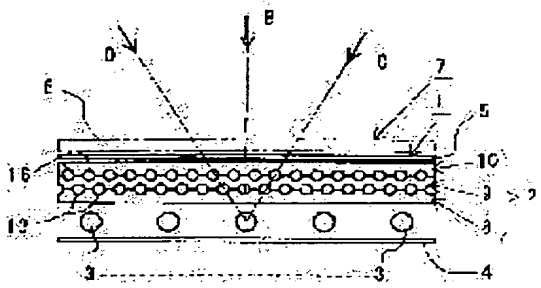
(54) ASSEMBLY OF DIFFUSING MEMBER, SURFACE LIGHT SOURCE DEVICE AND IMAGE DISPLAY DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To make the illumination light uniform in the normal direction and in the oblique direction of a light exiting face.
SOLUTION: A plurality of fluorescent lamps 3 are disposed in the back face side of the assembly of a diffusing member, a reflecting member 4 is disposed below the fluorescent lamps 3, and a diffusing sheet 5 is disposed in the exiting side (upper face side) of the assembly of the diffusing member. The assembly 2 of the diffusing member has a three-layer structure including a first layer 8 to a third layer 10, each layer composed of a plurality of diffusing member blocks. A plurality of holes 13, 16 each having a circular cross section are formed on the stacking faces of the layers, while the holes 13 shifted by a half of the pitch from the holes 16.



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* NOTICES *

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CLAIMS

[Claim(s)]

[Claim 1] The 1st layer which is the diffusion member assembly which diffuses and carries out outgoing radiation of the light from the light source arranged to the rear-face side, and consists of one or more diffusion member blocks, The diffusion member assembly characterized by having at least the 2nd layer which consists of one or more diffusion member blocks repeated in this 1st layer, and coming to form many crevices at least in one side of the superposition side of said 1st layer and said 2nd layer.

[Claim 2] The 1st layer which is the diffusion member assembly which diffuses and carries out outgoing radiation of the light from the light source arranged to the rear-face side, and consists of one or more diffusion member blocks, The 2nd layer which consists of one or more diffusion member blocks repeated in this 1st layer, The diffusion member assembly characterized by having even if few, forming many 1st crevice in the field which counters said 2nd layer of said 1st layer, and coming to form many 2nd crevice which is located between said 1st crevice in the field which counters said 1st layer of said 2nd layer.
[Claim 3] The diffusion member assembly according to claim 1 or 2 which makes it the description as the diffusion member block which constitutes said 1st layer, and the diffusion member block which constitutes said 2nd layer are formed in different magnitude and the comparison location of each diffusion member block of said 1st layer and the comparison location of each diffusion member block of said 2nd layer stop lapping.
[Claim 4] The 1st layer which is the diffusion member assembly which diffuses and carries out outgoing radiation of the light from the light source arranged to the rear-face side, and consists of one or more diffusion member blocks, The 2nd layer which consists of one or more diffusion member blocks repeated in this 1st layer, While having at least the 3rd layer which consists of one or more diffusion member blocks repeated in this 2nd layer and forming many 1st crevice at least in one side of the superposition side of said 1st layer and said 2nd layer The diffusion member assembly characterized by arranging and becoming so that many 2nd crevice may be formed at least in one side of the superposition side of said 2nd layer and said 3rd layer and said 2nd crevice may be located between said 1st crevice.
[Claim 5] The 1st layer which is the diffusion member assembly which diffuses and carries out outgoing radiation of the light from the light source arranged to the rear-face side, and consists of one or more diffusion member blocks, The 2nd layer which consists of one or more diffusion member blocks repeated in this 1st layer, In the field which has at least the 3rd layer which consists of one or more diffusion member blocks repeated in this 2nd layer, and counters said 2nd layer of said 1st layer Are the field which forms many 1st crevice of a cross-section abbreviation hemicycle, and counters said 1st layer of said 2nd layer, and in the location corresponding to said 1st crevice In the field which forms the 2nd crevice of a cross-section abbreviation hemicycle, and counters said 3rd layer of said 2nd layer The diffusion member assembly characterized by forming the 3rd crevice of a cross-section abbreviation hemicycle so that it may be located between said 2nd crevice, being the field which counters said 2nd layer of said 3rd layer, and coming to form the 4th crevice of a cross-section abbreviation hemicycle in the location corresponding to said 3rd crevice.
[Claim 6] The diffusion member block which constitutes said 1st layer, and the diffusion member block which constitutes said 2nd layer are formed in different magnitude. It is made for the comparison location of each diffusion member block of said 1st layer and the comparison location of each diffusion member block of said 2nd layer not to lap. The diffusion member block which constitutes said 2nd layer, and the diffusion member block which constitutes said 3rd layer are formed in different magnitude. The diffusion member assembly according to claim 4 or 5 which makes it the description as the comparison location of each diffusion member block of said 2nd layer and the comparison location of each diffusion member block of said 3rd layer stop lapping.
[Claim 7] The diffusion member assembly according to claim 1 to 6 which uses said light source as a rod-like fluorescent lamp, and is characterized by coming to form said crevice in a line along with the longitudinal direction of said fluorescent lamp.
[Claim 8] The diffusion member assembly according to claim 1 to 7 characterized by coming to fill up said all crevices the light transmission nature matter of a different refractive index from said diffusion member block.
[Claim 9] The diffusion member assembly according to claim 1 to 7 characterized by coming to fill up the light transmission nature matter of a different refractive index from said diffusion member block to a part of crevice of said large number.
[Claim 10] Surface light source equipment characterized by having been located in the rear-face side of said diffusion member assembly according to claim 1 to 9 and this diffusion member assembly, and having the reflective member which reflects the light from said light source in the rear-face side of said diffusion member assembly.
[Claim 11] Surface light source equipment according to claim 10 characterized by coming to arrange the diffusion sheet of at least one sheet to the outgoing radiation side side of said diffusion member assembly.
[Claim 12] The image display device characterized by having surface light source equipment according to claim 10 or 11 and the image display section illuminated by this surface light source equipment.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the technique which arranges the light source to the tooth-back side of the diffusion member assembly which constitutes this surface light source equipment especially about the surface light source equipment which illuminates the image display sections, such as various image display devices, such as a liquid crystal television, a liquid crystal display monitor, car navigation equipment, and an advertising display, and these liquid crystal display panels, in the shape of a field from that rear-face side.
[0002]
[Description of the Prior Art] For example, the surface light source equipment 30 which illuminates the liquid crystal display panel of a liquid crystal display monitor as shown in drawing 11 from a rear-face side arranges two or more fluorescent lamps 32, diffuses the light from this fluorescent lamp 32 with the diffusion plate 31, and it carries out outgoing radiation to the rear-face side of the diffusion plate 31 as field-like illumination light.
[0003] However, such surface light source equipment 30 was [right above / of a fluorescent lamp 32] the brightest, and the interstitial segment of fluorescent lamps 32 and 32 became the darkest, and had the problem that light and darkness (brightness unevenness) arose from the diffusion plate 31 in the light by which outgoing radiation is carried out to the shape of a field.
[0004] Then, in order to, equalize the light from a fluorescent lamp 32 if possible and to carry out outgoing radiation from the diffusion plate 31 conventionally, a light-shielding film (protection-from-light pattern) 33 is formed in the part which is the rear-face side of the diffusion plate 31, and counters a fluorescent lamp 32, the outgoing radiation light from the right above part of a fluorescent lamp 32 is stopped, and the outgoing radiation of the light from between a fluorescent lamp 32 and 32 is urged.
[0005]
[Problem(s) to be Solved by the Invention] However, when it sees from the direction of slanting to the direction of a normal of the outgoing radiation side of the diffusion plate 31 of what can equalize the brightness of the outgoing radiation light to the direction of a normal of the outgoing radiation side of the diffusion plate 31, a light-shielding film 33 is not located between an observation location and a fluorescent lamp 32, but outgoing radiation

of such conventional surface light source equipment 30 is carried out from the diffusion plate 31, without shading the light from a fluorescent lamp 32 by the light-shielding film 33. Consequently, when it saw from the direction of slanting to the direction of a normal of the outgoing radiation side of the diffusion plate 31, it had the problem that the difference of the light and darkness of outgoing radiation light was emphasized, and lighting quality deteriorated.

[0006] Then, this invention aims at offering surface light source equipment equipped with the diffusion member assembly which can equalize the illumination light to the direction of a normal and the direction of slant of an outgoing radiation side, and this diffusion member assembly, and the image display device equipped with this surface light source equipment.

[0007]

[Means for Solving the Problem] The 1st layer which invention of claim 1 is a diffusion member assembly which diffuses and carries out outgoing radiation of the light from the light source arranged to the rear-face side, and consists of one or more diffusion member blocks, It has at least the 2nd layer which consists of one or more diffusion member blocks repeated in this 1st layer, and is characterized by coming to form many crevices at least in one side of the superposition side of said 1st layer and said 2nd layer.

[0008] The 1st layer which invention of claim 2 is a diffusion member assembly which diffuses and carries out outgoing radiation of the light from the light source arranged to the rear-face side, and consists of one or more diffusion member blocks, The 2nd layer which consists of one or more diffusion member blocks repeated in this 1st layer, It is characterized by having, even if few, forming many 1st crevice in the field which counters said 2nd layer of said 1st layer, and coming to form many 2nd crevice which is located between said 1st crevice in the field which counters said 1st layer of said 2nd layer.

[0009] Invention of claim 3 forms in different magnitude the diffusion member block which constitutes said 1st layer, and the diffusion member block which constitute said 2nd layer, and it makes it the description in claim 1 or invention of 2, as the comparison location of each diffusion member block of said 1st layer and the comparison location of each diffusion member block of said 2nd layer stop lapping.

[0010] The 1st layer which invention of claim 4 is a diffusion member assembly which diffuses and carries out outgoing radiation of the light from the light source arranged to the rear-face side, and consists of one or more diffusion member blocks, The 2nd layer which consists of one or more diffusion member blocks repeated in this 1st layer, While having at least the 3rd layer which consists of one or more diffusion member blocks repeated in this 2nd layer and forming many 1st crevice at least in one side of the superposition side of said 1st layer and said 2nd layer Many 2nd crevice is formed at least in one side of the superposition side of said 2nd layer and said 3rd layer, and it is characterized by arranging and becoming so that said 2nd crevice may be located between said 1st crevice.

[0011] Invention of claim 5 is the diffusion member assembly which diffuses and carries out outgoing radiation of the light from the light source arranged to the rear-face side, and has at least the 1st layer which consists of one or more diffusion member blocks, the 2nd layer which consist of one or more diffusion member blocks repeated in this 1st layer, and the 3rd layer which consist of one or more diffusion member blocks repeated in this 2nd layer. And many 1st crevice of a cross-section abbreviation hemicycle is formed in the field which counters said 2nd layer of said 1st layer. Moreover, it is the field which counters said 1st layer of said 2nd layer, and the 2nd crevice of a cross-section abbreviation hemicycle is formed in the location corresponding to said 1st crevice. Moreover, the 3rd crevice of a cross-section abbreviation hemicycle is formed in the field which counters said 3rd layer of said 2nd layer so that it may be located between said 2nd crevice. And it is the field which counters said 2nd layer of said 3rd layer, and the 4th crevice of a cross-section abbreviation hemicycle is formed in the location corresponding to said 3rd crevice.

[0012] Invention of claim 6 forms in different magnitude the diffusion member block which constitutes said 1st layer, and the diffusion member block which constitutes said 2nd layer in claim 4 or invention of 5, and it is made for the comparison location of each diffusion member block of said 1st layer and the comparison location of each diffusion member block of said 2nd layer to have not lapped. Moreover, this invention forms in different magnitude the diffusion member block which constitutes said 2nd layer, and the diffusion member block which constitutes said 3rd layer, and it is made for the comparison location of each diffusion member block of said 2nd layer and the comparison location of each diffusion member block of said 3rd layer to have not lapped.

[0013] In one diffusion member assembly of claims 1-6, invention of claim 7 uses said light source as a rod-like fluorescent lamp, and is characterized by coming to form said crevice in a line along with the longitudinal direction of said fluorescent lamp.

[0014] Invention of claim 8 is characterized by coming to fill up the light transmission nature matter of a refractive index which is different from said diffusion member block in said all crevices in one diffusion member assembly of claims 1-7.

[0015] Invention of claim 9 is characterized by coming to fill up the light transmission nature matter of a refractive index which is different from said diffusion member block in a part of crevice of said large number in one diffusion member assembly of claims 1-7.

[0016] The surface light source equipment concerning invention of claim 10 is characterized by having been located in the rear-face side of a diffusion member assembly according to claim 1 to 9 and this diffusion member assembly, and having the reflective member which reflects the light from said light source in the rear-face side of said diffusion member assembly.

[0017] Invention of claim 11 is characterized by coming to arrange the diffusion sheet of at least one sheet to the outgoing radiation side side of said diffusion member assembly in the surface light source equipment concerning claim 10.

[0018] The image display device concerning invention of claim 12 is characterized by having surface light source equipment according to claim 10 or 11 and the image display section illuminated by this surface light source equipment.

[0019]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained in full detail based on a drawing.

[0020] [Gestalt of the 1st operation] drawing 1 is the appearance perspective view of the surface light source equipment concerning the gestalt of operation of this invention. Moreover, drawing 2 is the decomposition perspective view of the surface light source equipment of drawing 1 . Moreover, drawing 4 is a sectional view cut and shown along with the A-A line of drawing 1 .

[0021] (Outline configuration of surface light source equipment and an image display device) As shown in these drawings, the surface light source equipment 1 concerning the gestalt of this operation arranges the fluorescent lamp (light source) 3 of the shape of two or more rod at the predetermined spacing to the rear-face side (the drawing 1 and drawing 2 side and inferior-surface-of-tongue side of drawing 4) of the diffusion member assembly 2, and arranges the reflective member 4 to the lower part side of those fluorescent lamps 3. This reflective member 4 reflects the light from a fluorescent lamp 3 in the rear-face side of the diffusion member assembly 2. And the diffusion sheet 5 is arranged to the outgoing radiation side side (upper part side) of the diffusion member assembly 2, and the light which carried out outgoing radiation from the diffusion member assembly 2 is diffused with the diffusion sheet 5. In addition, as shown in drawing 4 , the image display device 7 illuminated with the light of the shape of a field which carried out outgoing radiation of the liquid crystal display panel 6 from surface light source equipment 1 is constituted by arranging the liquid crystal display panel (image display section) 6 in piles on the diffusion sheet 5 of surface light source equipment 1.

[0022] (Diffusion member assembly) A diffusion member assembly is a three-tiered structure from the 1st layer 8 to the 3rd layer 10. Among these, the 1st layer 8 is formed in square tabular [which corresponds to the flat-surface configuration of the liquid crystal display panel 6] by combining six diffusion member blocks 8a-8f which are square plates, as shown in drawing 3 . That is, the 1st layer 8 arranges two diffusion member blocks 8a-8f perpendicularly, and arranges them three pieces horizontally (a total of two-line three trains [six] should be located in a line), and is formed in square tabular by making close an each diffusion member blocks [8a-8f] side face.

[0023] Moreover, the 2nd layer 9 is formed in square tabular [which corresponds to the flat-surface configuration of the liquid crystal display panel 6] by combining 15 diffusion member blocks 9a-9o which are square plates, as shown in drawing 3 . That is, the 2nd layer 9 arranges three diffusion member blocks 9a-9o perpendicularly, and arranges them five pieces horizontally (a total of three-line five trains [15] should be located in a line), and is formed in square tabular by making close the side face of each diffusion member blocks 9a-9o. And the comparison location of each diffusion member blocks 9a-9o of this 2nd layer 9 laps with an each diffusion member blocks [of the 1st layer 8 / 8a-8f] comparison location.

[0024] Moreover, the 3rd layer 10 is formed in square tabular [which corresponds to the flat-surface configuration of the liquid crystal display panel 6] by combining two diffusion member blocks 10a and 10b which are square plates. Namely, the 3rd layer 10 arranges two diffusion member blocks 10a and 10b horizontally, and has formed them in square tabular by making close the side face of both diffusion member blocks 10a and 10b. And the

comparison location of both diffusion member blocks 10a and 10b of this 3rd layer 10 laps with the comparison location of each diffusion member blocks 9a–9o of the 2nd layer 9.

[0025] Here, each diffusion member blocks 8a–8f of each class from the 1st layer 8 to the 3rd layer 10, 9a–9o, and 10a–10b are formed in the desired configuration by carrying out injection molding of acrylic resin (PMMA) excellent in light transmission nature, a polycarbonate (PC), cycloolefin system resin, etc.

[0026] Drawing 5 is the partial enlarged drawing of the diffusion member assembly 2 shown in drawing 4 . Moreover, drawing 6 is the partial enlarged drawing in which decomposing into each class from the 1st layer 8 to the 3rd layer 10, and showing the diffusion member assembly 2 shown in drawing 5 .

[0027] As shown in these drawings, cross-section abbreviation hemicycle-like many 1st crevice 11 is formed in the field which counters the diffusion member blocks 9a–9o of the 2nd diffusion member blocks [of the 1st layer 8 / 8a–8f] layer 9 at equal intervals. Moreover, many 2nd crevice 12 of the cross-section abbreviation hemicycle which counters the 1st crevice 11 of the 1st layer 8 is formed in the field which counters the diffusion member blocks 8a–8f of the 1st layer 8 of the diffusion member blocks 9a–9o of the 2nd layer 9 at equal intervals. Consequently, if the diffusion member blocks 8a–8f of the 1st layer 8 and the diffusion member blocks 9a–9o of the 2nd layer 9 are stuck in piles, the hole section 13 of a cross-section approximate circle form will be formed of the 1st crevice 11 and 2nd crevice 12.

[0028] A large number are formed in the field which counters the diffusion member blocks 10a and 10b of the 3rd layer 10 of the diffusion member blocks 9a–9o of the 2nd layer 9 in the same pitch P as the formation pitch of the 2nd crevice 12 so that the 3rd crevice 14 of a cross-section abbreviation hemicycle may be located between said 2nd crevice 12. Moreover, many 4th crevice 15 of the cross-section abbreviation hemicycle which counters the 3rd crevice 14 of the 2nd layer 9 is formed in the field which counters the diffusion member blocks 9a–9o of the 2nd layer 9 of the diffusion member blocks 10a and 10b of the 3rd layer 10 at equal intervals. Consequently, if the diffusion member blocks 9a–9o of the 2nd layer 9 and the diffusion member blocks 10a and 10b of the 3rd layer 10 are stuck in piles, the hole section 16 of a cross-section approximate circle form will be formed of the 3rd crevice 14 and 4th crevice 15. In addition, when the radius of crevices 11, 12, 14, and 15 is set to R, as for each crevices 11, 12, and 14 and the pitch P between 15, determining in the range of 2 R<=P<=4R is desirable.

[0029] The case where it sees from the upper part of the diffusion member assembly 2 here (from [of drawing 4] B), When it sees from across (C of drawing 4 , the direction of D), the hole section 16 made in the superposition side of the 2nd layer 9 and the 3rd layer 10 is located between the hole sections 13 made in the superposition side of the 1st layer 8 and the 2nd layer 9 (if it puts in another way). The hole section 16 is half-pitch gap ****** to the hole section 13. And as for this diffusion member assembly 2, air exists in the hole section 13 and 16. a diffusion member block (8a ... 10b) and the hole sections 13 and 16 — the rate of optical refraction -- large — differing (for example, the refractive index of PMMA being about 1.49 and the refractive index of PC being 1.59) -- Since the cross-section configuration of the hole sections 13 and 16 is an approximate circle form, in case the light from a fluorescent lamp 3 penetrates the diffusion member assembly 2, it is effectively spread in the hole sections 13 and 16. That is, since the light from a fluorescent lamp 3 has diffused in homogeneity in the hole sections 13 and 16 when the diffusion member assembly 2 is seen from the upper part (the direction of B of drawing 4) and it sees [not to mention] from the slanting upper part (C of drawing 4 , the direction of D), the brightness of outgoing radiation light equalizes and it is hard to produce the difference of the light and darkness of outgoing radiation light.

[0030] In addition, in the gestalt of this operation, when pasting up the diffusion member blocks (8a–8f, 9a–9o, 10a–10b) which each class adjoins and unifying, it is desirable for a diffusion member block (8a ... 10b) and a refractive index to use the almost same adhesives (for example, epoxy resin adhesive).

[0031] (Reflective member) As shown in drawing 1 – drawing 2 , and drawing 4 , the reflective member 4 is formed in the inside of metal plates, such as resin ingredients, such as polyethylene terephthalate (PET) of the white excellent in light reflex nature, or a stainless steel plate, by the thing in which the silver vacuum evaporationo layer was formed etc., and reflects the light from a fluorescent lamp 3 to the rear-face side of the light guide plate assembly 2 effectively.

[0032] (Diffusion sheet) As shown in drawing 1 – drawing 2 , and drawing 4 , the diffusion sheet 5 carries out surface roughening of the front faces, such as a PET sheet excellent in light transmission nature, forms an optical diffusion pattern in the front face in the ink which has optical diffusibility, and makes the interior contain an optical diffusate, and diffuses effectively the light which carries out outgoing radiation from the diffusion member assembly 2. Consequently, when surface light source equipment 1 is seen [of the diffusion sheet 5] from an outgoing radiation side, the comparison section (division section from the 1st layer 8 to the 3rd layer 10) of a diffusion member block (8a–8f, 9a–9o, 10a–10b) of each class from the 1st layer 8 to the 3rd layer 10 stops being able to be conspicuous easily.

[0033] (An operation and effectiveness of the gestalt of this operation) The surface light source equipment 1 concerning the gestalt of these above operations If it is reflected by the direct or reflective member 4 and the light of a fluorescent lamp 3 carries out incidence from the diffusion member block 8a–8f inferior surface of tongue of the 1st layer 8 of the diffusion member assembly 2 A refraction operation is received by the interface with the crevices 11 and 12 (hole section 13) formed in the superposition side of the 1st layer 8 and the 2nd layer 9 in the process in which the incident light spreads the inside of diffusion member block 8a–8f of the 1st layer 8. Here, the cross-section configuration of the hole section 13 is an approximate circle form configuration, and since air exists in the interior of the hole section 13 and the rate of optical refraction of the interior of the hole section 13 and the diffusion member blocks 8a–9o of the 1st and 2nd layers 8 and 9 is moreover greatly different from it, the light which spreads the inside of diffusion member block 8a–8f of the 1st layer 8 diffuses in homogeneity.

[0034] And if the light which is not diffused in the hole section 13 formed in the superposition side of the 1st above-mentioned layer 8 and the 2nd layer 9 and the diffused light spread the inside of diffusion member block 9a – 9o of the 2nd layer 9 A refraction operation is received by the interface with the crevices 14 and 15 (hole section 16) formed in the superposition side of the 2nd layer 9 and the 3rd layer 10. Here, since the hole section 16 formed in the superposition side of this 2nd layer 9 and the 3rd layer 10 is the same as that of the hole section 13 formed between the 1st above-mentioned layer 8 and the 2nd layer 9, the light which spreads the inside of the 2nd layer 9 diffuses it in homogeneity in that hole section 16. That is, the hole section 16 formed in the superposition side of the 2nd layer 9 and the 3rd layer 10 can diffuse the light which was not able to be diffused in the hole section 13 formed in the superposition side of the 1st layer 8 and the 2nd layer 9. In addition, the typical optical path of the light which receives and diffuses a refraction operation in an interface with the hole sections 13 and 16 in drawing 10 is shown notionally.

[0035] Therefore, the outgoing radiation light from the diffusion member assembly 2 is equalized also in the direction of slanting (C of drawing 4 , the direction of D) to the direction of a normal not to mention the direction of a normal of an outgoing radiation side (the direction of B of drawing 4). That is, in the surface light source equipment 1 of the gestalt of this operation, lighting quality of outgoing radiation light from the diffusion member assembly 2 improves so that brightness unevenness may not arise according to the observation direction.

[0036] And the light which carried out outgoing radiation from the diffusion member assembly 2 passes the diffusion sheet 5, and is used as illumination light of the liquid crystal display panel 6. Although abnormality luminescence of the stripe-like bright line occurring may be observed when the diffusion member block with which each class adjoins each other cannot fully be stuck here and an optical interface exists along the boundary Abnormality luminescence produced in the each diffusion member blocks [of the 1st layer 8 / 8a–8f] comparison section diffuses with the 2nd layer 9, 3rd layer 10, and diffusion sheet 5. Abnormality luminescence produced in the comparison section of each diffusion member blocks 9a–9o of the 2nd layer 9 diffuses with the 3rd layer 10 and diffusion sheet 5. abnormality luminescence produced in the comparison section of diffusion member block 10a of the 3rd layer 10 and 10b diffuses with the diffusion sheet 5 — having — each diffusion member block 8a ... abnormality luminescence produced in the comparison section of 10b stops being conspicuous Consequently, the surface light source equipment 1 concerning the gestalt of this operation can illuminate the liquid crystal display panel 6 with a bright uniform light, and the display of the liquid crystal display panel 6 becomes legible.

[0037] Moreover, since the surface light source equipment 1 concerning the gestalt of this operation does not need to form a light-shielding film (protection-from-light pattern) like the conventional example, it can raise whenever [outgoing radiation luminosity] so that light may not be absorbed by the light-shielding film.

[0038] Moreover, since the surface light source equipment 1 concerning the gestalt of this operation multilayers the diffusion member assembly 2 in the 1st – the 3rd layer 8–10, divides each class 8–10 into two or more diffusion member blocks 8a–8f, 9a–9o, and 10a–10b and is constituted, Small diffusion member block 8a ... By making [many] the combination number of 10b, the exit light surface product of the diffusion member assembly 2 can

be enlarged easily. therefore — according to the gestalt of this operation — diffusion member block 8a ... while the metal mold for carrying out injection molding of the 10b is small and ends — the magnitude (magnitude of a display screen) of the liquid crystal display panel 6 — not being concerned — diffusion member block 8a ... injection molding of 10b — public funds — it becomes possible to manufacture easily the surface light source equipment 1 for large-sized screens, without enlarging a manufacturing facility, since a mold can be shared.
[0039] Moreover, since the inside of the hole section 13 of the diffusion member assembly 2 and 16 is an air space, the surface light source equipment 1 concerning the gestalt of this operation can attain lightweight-ization of whole weight.
[0040] moreover, diffusion member block 8a of plurality [assembly / 2 / concerning the gestalt of this operation / diffusion member / each class / 8-10] ... it divides into 10b — having — **** — each diffusion member block 8a ... in order that 10b may be small and may tend to carry out injection molding, it is hard to produce poor shaping and the rate of the yield of a product is good.
[0041] [Gestalt of the 2nd operation] drawing 7 is the side elevation expanding and showing some diffusion member assemblies 2 concerning the gestalt of operation of the 2nd of this invention.
[0042] As shown in drawing 7 , the gestalt of this operation forms many 1st crevice 20 of a cross-section abbreviation hemicycle in either of the superposition sides of the 1st layer 8 and the 2nd layer 9, and forms many 2nd crevice 21 of a cross-section abbreviation hemicycle in either of the superposition sides of the 2nd layer 9 and the 3rd layer 10. In addition, each class of the 1st layer 8 to the 3rd layer 10 is two or more diffusion member block 8a like the gestalt of the 1st operation of the above-mentioned... It is constituted combining 10b (refer to drawing 3).
[0043] Namely, the 1st example of the gestalt of this operation forms the 1st crevice 20 in the field which counters the 2nd layer 9 of the 1st layer 8, as shown in drawing 7 (a). The 2nd crevice 21 is formed in the field which counters the 2nd layer 9 of the 3rd layer 10, and, moreover, the 2nd crevice 21 is located between the 1st crevice 20 and 20 (if it puts in another way, the 2nd crevice 21 will be half-pitch gap ****** to the 1st crevice 20).
[0044] Moreover, the 2nd example of the gestalt of this operation forms the 1st crevice 20 in the field which counters the 1st layer 8 of the 2nd layer 9, as shown in drawing 7 (b). The 2nd crevice 21 is formed in the field which counters the 3rd layer 10 of the 2nd layer 9, and, moreover, the 2nd crevice 21 is located between the 1st crevice 20 and 20.
[0045] Moreover, the 3rd example of the gestalt of this operation forms the 1st crevice 20 in the field which counters the 1st layer 8 of the 2nd layer 9, as shown in drawing 7 (c). The 2nd crevice 21 is formed in the field which counters the 2nd layer 9 of the 3rd layer 10, and, moreover, the 2nd crevice 21 is located between the 1st crevice 20 and 20.
[0046] Moreover, the 4th example of the gestalt of this operation forms the 1st crevice 20 in the field which counters the 2nd layer 9 of the 1st layer 8, as shown in drawing 7 (d). The 2nd crevice 21 is formed in the field which counters the 3rd layer 10 of the 2nd layer 9, and, moreover, the 2nd crevice 21 is located between the 1st crevice 20 and 20.
[0047] Also in the gestalt of this implementation of such a configuration, since the light from a fluorescent lamp 3 can be diffused by each crevices 20 and 21 and outgoing radiation of the light can be carried out to homogeneity from the outgoing radiation side of the diffusion member assembly 2, generating of the brightness unevenness of the outgoing radiation light by the observation direction can be prevented effectively.
[0048] Moreover, also in the gestalt of this operation, the same effectiveness as the gestalt of the 1st operation of the above-mentioned can be acquired.
[0049] [Gestalt of the 3rd operation] drawing 8 is the side elevation expanding and showing some diffusion member assemblies 2 concerning the gestalt of operation of the 3rd of this invention.
[0050] The gestalt of this operation constitutes the diffusion member assembly 2 from the 1st layer 8 and 2nd layer 9, and forms many crevices 22 at least in one side of the superposition side of these 1st layers 8 and the 2nd layer 9. In addition, the 1st layer 8 and 2nd layer 9 of a gestalt of this operation are constituted combining two or more diffusion member blocks 8a-8f, and 9a-9o like the gestalt of each above-mentioned operation.
[0051] That is, as shown in drawing 8 (a), the 1st example of the gestalt of this operation makes crevices 22 and 22 counter the superposition side of the 1st layer 8 and the 2nd layer 9, and is formed in it. Moreover, the 2nd example forms many crevices 22 in the field which counters the 2nd layer 9 of the 1st layer 8, as shown in drawing 8 (b). Moreover, the 3rd example forms many crevices 22 in the field which counters the 1st layer 8 of the 2nd layer 9, as shown in drawing 8 (c). in addition, these the 1- the crevice 22 of the 3rd example is continuously formed by the smooth curve, and an adjacent crevice 22 and no less than 22 adjacent comrades are also connected by the smooth curve. Therefore, the cross-section configuration of the field which forms a crevice 22 is presenting the abbreviation wave configuration.
[0052] Moreover, the 4th example forms many crevices 22 and 22 of a cross-section abbreviation hemicycle in each superposition side of the 1st layer 8 and the 2nd layer 9, respectively, as shown in drawing 8 (d), and the crevice 22 of the 2nd layer 9 is located between the crevice 22 of the 1st layer 8, and 22.
[0053] The diffusion member assembly 2 concerning the gestalt of such this operation can also diffuse the light from a fluorescent lamp in a crevice 22, and can prevent generating of the brightness unevenness by the observation direction effectively.
[0054] In addition, since the diffusion member assembly 2 concerning the gestalt of this operation has few layers, thin-shape-izing and lightweight-ization of the image display device 7 equipped with surface light source equipment 1 and this surface light source equipment 1 can be attained.
[0055] Although the mode to which air exists in crevices 11-12, 14-15, and 20-22 is illustrated, it is not restricted to this, but the gestalt of each [other modification] above-mentioned operation is diffusion member block 8a in crevices 11-12, 14-15, and 20-22... You may make it filled up with the light transmission nature matter of the refractive index of 10b, and a different refractive index. Moreover, crevices 11-12, 14-15, and the light transmission nature matter with which 20-22 are filled up are diffusion member block 8a... Mixing distribution of the minute particle which has a refractive index which is different from this into 10b, congener, or an ingredient of a different kind may be carried out. In addition, all of crevices 11-12, 14-15, and 20-22 may be filled up with the light transmission nature matter, and you may make it fill up the part with it.
[0056] Moreover, in the gestalt of each above-mentioned operation, although the crevices 11-12 of the cross-section configuration continuously formed by the abbreviation hemicycle or the smooth curve, 14-15, and 20-22 were illustrated, the crevice of a cross-section abbreviation triangle and the crevice of other cross-section configurations are [that what is necessary is just the crevice of the cross-section configuration which is not restricted to this but can diffuse light] sufficient.
[0057] Moreover, although the gestalt of each above-mentioned operation has illustrated the mode which constitutes the diffusion member assembly 2 from three layers or two-layer, it is not restricted to this but may use the diffusion member assembly 2 as the multilayer-structure object of four or more layers.
[0058] Moreover, although the gestalt of each above-mentioned operation illustrates crevices 11-12, 14-15, and the mode that forms 20-22 in a line along with the longitudinal direction of a fluorescent lamp as shown in drawing 9 , it may be made into the mode which is not restricted to this, for example, forms many crevices in the shape of a dot.
[0059] Moreover, although the formation pitch of a crevice (hole section) is made fixed with the gestalt of each above-mentioned operation, you may make it change the roughness and fineness of the formation pitch according to a relative location with the light source arranged to a rear-face side.
[0060]
[Effect of the Invention] As mentioned above, since the diffusion member assembly which this invention diffuses the light from the light source arranged to the rear-face side, and carries out outgoing radiation can diffuse light in homogeneity in the crevice which is a multilayer-structure object and was formed at least in one side of the superposition side of each class, According to the observation direction, it can stop effectively that brightness unevenness arises, and not to mention the direction of a normal of an outgoing radiation side, the luminance distribution of the outgoing radiation light to the direction of slanting can also be equalized to the direction of a normal of an outgoing radiation side, and improvement in lighting quality can be aimed at.
[0061] Moreover, since the crevice which formed this invention at least in one side of the superposition side of each class of a diffusion member assembly diffuses light, it is not necessary to form a protection-from-light pattern like the conventional example in a diffusion member, and only the part which does not have the absorption of light by the protection-from-light pattern at least can raise whenever [outgoing radiation luminosity].
[0062] Therefore, surface light source equipment equipped with the diffusion member assembly concerning this invention is formed into high brightness while the illumination light which illuminates the image display section equalizes. Consequently, the image display device equipped with such

surface light source equipment becomes the display image by the image display section is bright, and legible.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the appearance perspective view of the surface light source equipment concerning the gestalt of operation of the 1st of this invention.
[Drawing 2] It is the perspective view disassembling and showing the surface light source equipment of drawing 1 .
[Drawing 3] It is the top view disassembling and showing the diffusion member assembly concerning the gestalt of operation of the 1st of this invention.
[Drawing 4] It is the sectional view cut and shown along with the A-A line of drawing 1 .
[Drawing 5] It is the partial enlarged drawing of the diffusion member assembly shown in drawing 4 .
[Drawing 6] It is the partial enlarged drawing disassembling and showing the diffusion member assembly shown in drawing 5 .
[Drawing 7] It is the partial enlarged drawing of the diffusion member assembly concerning the gestalt of operation of the 2nd of this invention.
[Drawing 8] It is the partial enlarged drawing of the diffusion member assembly concerning the gestalt of operation of the 3rd of this invention.
[Drawing 9] It is the perspective view showing the configuration of the crevice formed in each class of a diffusion member assembly.
[Drawing 10] It is drawing showing notionally the typical optical path of the light diffused in response to a refraction operation in an interface with the hole section.
[Drawing 11] It is the side elevation expanding and showing some conventional surface light source equipments.
[Description of Notations]
1 .... Surface light source equipment, 2 .. A diffusion member assembly, 3 .. Fluorescent lamp (light source), 4 .... A reflective member, 5 .. A diffusion sheet, 6 .. Liquid crystal display panel (image display section), 7 [.. The 3rd layer, 8a-8f, 9a-9o, 10a-10b / .. A diffusion member block, 11, 12, 14, 15, 20, 21, 22 / .. Crevice] .... An image display device, 8 .. The 1st layer, 9 .. The 2nd layer, 10

[Translation done.]

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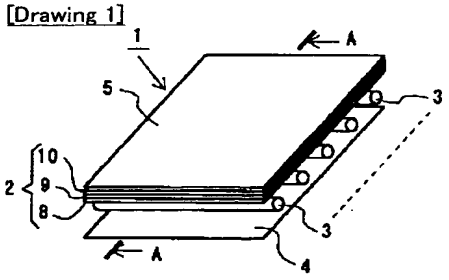
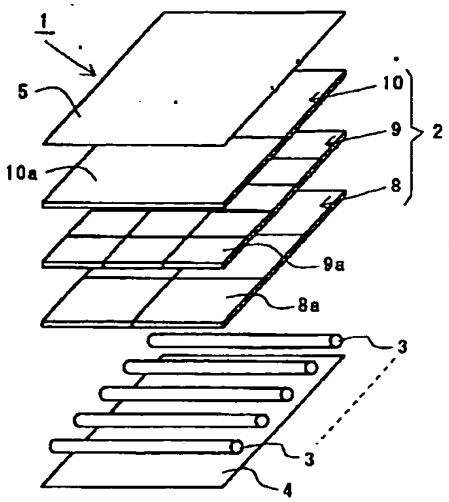
DRAWINGS

[Drawing 1]



[Drawing 2]



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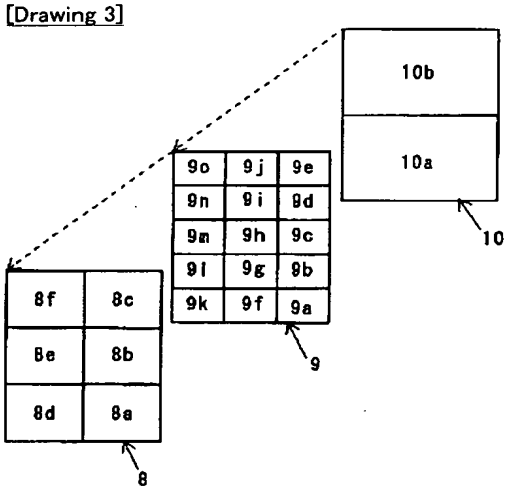

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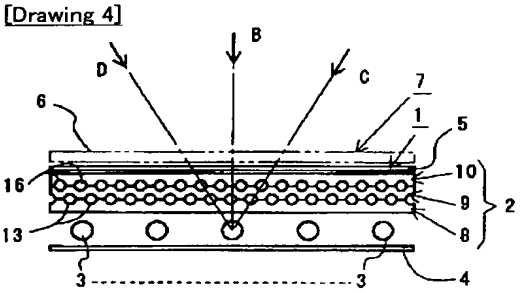

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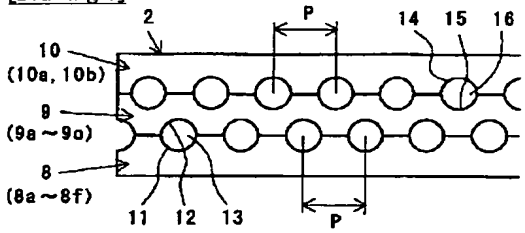

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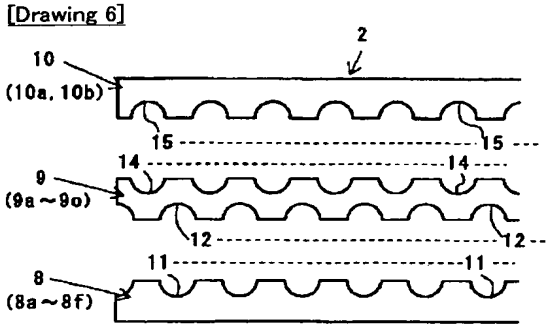
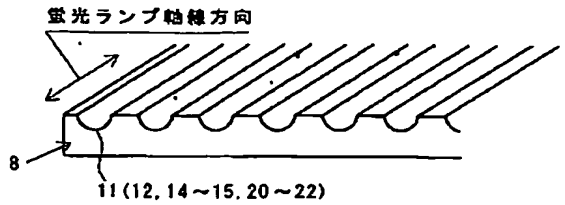


[Drawing 9]



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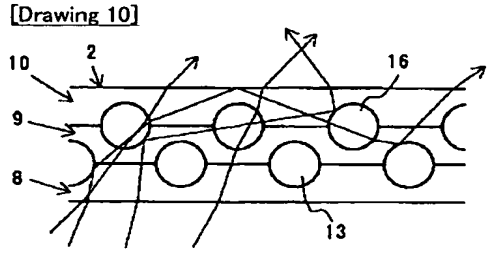
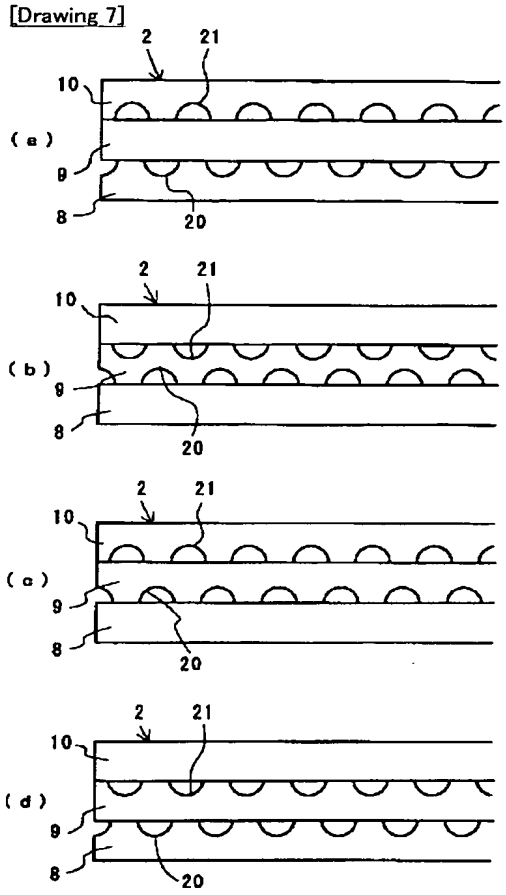
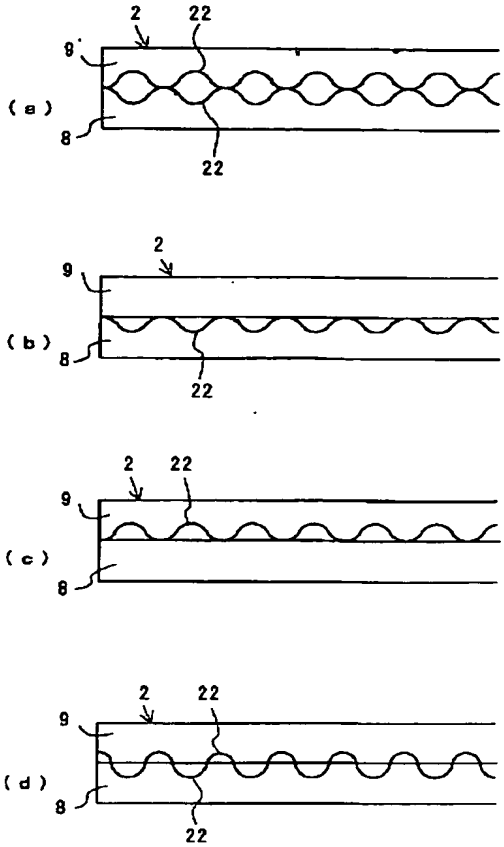


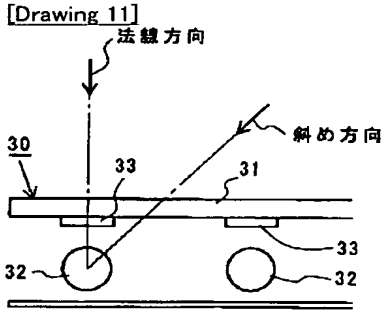
[Drawing 7]



[Drawing 8]



[Drawing 11]



[Translation done.]

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Ｇ０９Ｆ	9/00	３２４			３３６Ｇ	
		３３６	Ｆ２１Ｙ 103:00			

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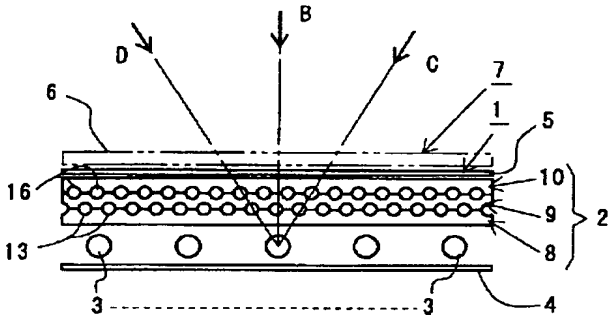
2H091 FA14Z FA32Z FA42Z LA17 LA18
5G435 AA02 BB03 BB12 BB15 DD13 FF06 GG24 GG26 HH04 KK07

(54)【発明の名称】　拡散部材組立体、面光源装置及び画像表示装置

(57)【要約】
【課題】　出射面の法線方向及び斜め方向への照明光を均一化する。
【解決手段】　拡散部材組立体２の裏面側に複数の蛍光ランプ３を配置し、蛍光ランプ３の下方に反射部材４を配置し、拡散部材組立体の出射面側（上面側）に拡散シート５を配置してある。拡散部材組立体２は、第１の層８から第３の層１０までの３層構造であり、各層を複数の拡散部材ブロックで構成してある。各層の重ね合わせ面に断面形状が略円形形状の空孔部１３，１６をそれぞれ複数形成してあり、空孔部１３と空孔部１６を半ピッチずらして形成してある。



1

【特許請求の範囲】

【請求項１】　裏面側に配置した光源からの光を拡散して出射する拡散部材組立体であって、

１以上の拡散部材ブロックからなる第１の層と、この第１の層に重ねられる１以上の拡散部材ブロックからなる第２の層と、を少なくとも有し、

前記第１の層と前記第２の層との重ね合わせ面の少なくとも一方に凹部を多数形成してなることを特徴とする拡散部材組立体。

【請求項２】　裏面側に配置した光源からの光を拡散して出射する拡散部材組立体であって、

１以上の拡散部材ブロックからなる第１の層と、この第１の層に重ねられる１以上の拡散部材ブロックからなる第２の層と、を少なくとも有し、

前記第１の層の前記第２の層に対向する面には第１の凹部を多数形成し、

前記第２の層の前記第１の層に対向する面には前記第１の凹部間に位置するような第２の凹部を多数形成してなることを特徴とする拡散部材組立体。

【請求項３】　前記第１の層を構成する拡散部材ブロックと前記第２の層を構成する拡散部材ブロックとを異なる大きさに形成し、前記第１の層の各拡散部材ブロックの突き合わせ位置と前記第２の層の各拡散部材ブロックの突き合わせ位置とが重ならないようにしてなることを特徴とする請求項１又は２に記載の拡散部材組立体。

【請求項４】　裏面側に配置した光源からの光を拡散して出射する拡散部材組立体であって、

１以上の拡散部材ブロックからなる第１の層と、この第１の層に重ねられる１以上の拡散部材ブロックからなる第２の層と、この第２の層に重ねられる１以上の拡散部材ブロックからなる第３の層を少なくとも有し、

前記第１の層と前記第２の層との重ね合わせ面の少なくとも一方に第１の凹部を多数形成すると共に、前記第２の層と前記第３の層との重ね合わせ面の少なくとも一方に第２の凹部を多数形成し、

前記第２の凹部を前記第１の凹部間に位置するように配置してなることを特徴とする拡散部材組立体。

【請求項５】　裏面側に配置した光源からの光を拡散して出射する拡散部材組立体であって、

１以上の拡散部材ブロックからなる第１の層と、この第１の層に重ねられる１以上の拡散部材ブロックからなる第２の層と、この第２の層に重ねられる１以上の拡散部材ブロックからなる第３の層を少なくとも有し、

前記第１の層の前記第２の層に対向する面には、断面略半円形の第１の凹部を多数形成し、

前記第２の層の前記第１の層に対向する面で、且つ前記第１の凹部に対応する位置には、断面略半円形の第２の凹部を形成し、

前記第２の層の前記第３の層に対向する面には、前記第２の凹部間に位置するように断面略半円形の第３の凹部

2

を形成し、

前記第３の層の前記第２の層に対向する面で、且つ前記第３の凹部に対応する位置には、断面略半円形の第４の凹部を形成してなることを特徴とする拡散部材組立体。

【請求項６】　前記第１の層を構成する拡散部材ブロックと前記第２の層を構成する拡散部材ブロックとを異なる大きさに形成し、前記第１の層の各拡散部材ブロックの突き合わせ位置と前記第２の層の各拡散部材ブロックの突き合わせ位置とが重ならないようにし、

前記第２の層を構成する拡散部材ブロックと前記第３の層を構成する拡散部材ブロックとを異なる大きさに形成し、前記第２の層の各拡散部材ブロックの突き合わせ位置と前記第３の層の各拡散部材ブロックの突き合わせ位置が重ならないようにしてなることを特徴とする請求項４又は５に記載の拡散部材組立体。

【請求項７】　前記光源を棒状の蛍光ランプとし、前記凹部を前記蛍光ランプの長手方向に沿って線状に形成してなることを特徴とする請求項１～６のいずれかに記載の拡散部材組立体。

【請求項８】　前記凹部の全てに、前記拡散部材ブロックと異なる屈折率の光透過性物質を充填してなることを特徴とする請求項１～７のいずれかに記載の拡散部材組立体。

【請求項９】　前記多数の凹部の一部に、前記拡散部材ブロックと異なる屈折率の光透過性物質を充填してなることを特徴とする請求項１～７のいずれかに記載の拡散部材組立体。

【請求項１０】　前記請求項１～９のいずれかに記載の拡散部材組立体と、この拡散部材組立体の裏面側に位置して、前記光源からの光を前記拡散部材組立体の裏面側に反射する反射部材と、を備えたことを特徴とする面光源装置。

【請求項１１】　前記拡散部材組立体の出射面側に少なくとも一枚の拡散シートを配置してなることを特徴とする請求項１０に記載の面光源装置。

【請求項１２】　請求項１０又は１１に記載の面光源装置と、この面光源装置によって照明される画像表示部と、を備えたことを特徴とする画像表示装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】この発明は、液晶テレビ、液晶モニター、カーナビゲーション装置、広告表示装置等の各種画像表示装置、及びこれらの液晶表示パネル等の画像表示部をその裏面側から面状に照明する面光源装置に関し、特に、この面光源装置を構成する拡散部材組立体の背面側に光源を配置する技術に関するものである。

【０００２】

【従来の技術】例えば、図１１に示すような、液晶モニターの液晶表示パネルを裏面側から照明する面光源装置３０は、拡散板３１の裏面側に複数の蛍光ランプ３２を

配置し、この蛍光ランプ３２からの光を拡散板３１で拡散して面状の照明光として出射するようになっている。

【０００３】しかし、このような面光源装置３０は、蛍光ランプ３２の直上で最も明るく、蛍光ランプ３２，３２の中間部分が最も暗くなり、拡散板３１から面状に出射される光に明暗（輝度むら）が生じるという問題を有していた。

【０００４】そこで、従来は、蛍光ランプ３２からの光をなるべく均一化して拡散板３１から出射させるため、拡散板３１の裏面側で且つ蛍光ランプ３２に対向する部位に遮光膜（遮光パターン）３３を形成し、蛍光ランプ３２の直上部分からの出射光を抑え、蛍光ランプ３２，３２間からの光の出射を促すようになっていた。

【０００５】

【発明が解決しようとする課題】しかしながら、このような従来の面光源装置３０は、拡散板３１の出射面の法線方向への出射光の輝度を均一化することができるものの、拡散板３１の出射面の法線方向に対して斜めの方向から見た場合、観察位置と蛍光ランプ３２との間には遮光膜３３が位置せず、蛍光ランプ３２からの光が遮光膜３３で遮光されずに拡散板３１から出射する。その結果、拡散板３１の出射面の法線方向に対して斜めの方向から見た場合には、出射光の明暗の差が強調されて照明品質が低下するという問題を有していた。

【０００６】そこで、本発明は、出射面の法線方向及び斜め方向への照明光を均一化することができる拡散部材組立体、この拡散部材組立体を備えた面光源装置、及びこの面光源装置を備えた画像表示装置を提供することを目的とする。

【０００７】

【課題を解決するための手段】請求項１の発明は、裏面側に配置した光源からの光を拡散して出射する拡散部材組立体であって、１以上の拡散部材ブロックからなる第１の層と、この第１の層に重ねられる１以上の拡散部材ブロックからなる第２の層と、を少なくとも有し、前記第１の層と前記第２の層との重ね合わせ面の少なくとも一方に凹部を多数形成してなることを特徴としている。

【０００８】請求項２の発明は、裏面側に配置した光源からの光を拡散して出射する拡散部材組立体であって、１以上の拡散部材ブロックからなる第１の層と、この第１の層に重ねられる１以上の拡散部材ブロックからなる第２の層と、を少なくとも有し、前記第１の層の前記第２の層に対向する面には第１の凹部を多数形成し、前記第２の層の前記第１の層に対向する面には前記第１の凹部間に位置するような第２の凹部を多数形成してなることを特徴としている。

【０００９】請求項３の発明は、請求項１又は２の発明において、前記第１の層を構成する拡散部材ブロックと前記第２の層を構成する拡散部材ブロックとを異なる大きさに形成し、前記第１の層の各拡散部材ブロックの突き合わせ位置と前記第２の層の各拡散部材ブロックの突き合わせ位置とが重ならないようにしてなることを特徴としている。

【００１０】請求項４の発明は、裏面側に配置した光源からの光を拡散して出射する拡散部材組立体であって、１以上の拡散部材ブロックからなる第１の層と、この第１の層に重ねられる１以上の拡散部材ブロックからなる第２の層と、この第２の層に重ねられる１以上の拡散部材ブロックからなる第３の層を少なくとも有し、前記第１の層と前記第２の層との重ね合わせ面の少なくとも一方に第１の凹部を多数形成すると共に、前記第２の層と前記第３の層との重ね合わせ面の少なくとも一方に第２の凹部を多数形成し、前記第２の凹部を前記第１の凹部間に位置するように配置してなることを特徴としている。

【００１１】請求項５の発明は、裏面側に配置した光源からの光を拡散して出射する拡散部材組立体であって、１以上の拡散部材ブロックからなる第１の層と、この第１の層に重ねられる１以上の拡散部材ブロックからなる第２の層と、この第２の層に重ねられる１以上の拡散部材ブロックからなる第３の層を少なくとも有している。そして、前記第１の層の前記第２の層に対向する面には、断面略半円形の第１の凹部を多数形成してある。また、前記第２の層の前記第１の層に対向する面で、且つ前記第１の凹部に対応する位置には、断面略半円形の第２の凹部を形成してある。また、前記第２の層の前記第３の層に対向する面には、前記第２の凹部間に位置するように断面略半円形の第３の凹部を形成してある。そして、前記第３の層の前記第２の層に対向する面で、且つ前記第３の凹部に対応する位置には、断面略半円形の第４の凹部を形成してある。

【００１２】請求項６の発明は、請求項４又は５の発明において、前記第１の層を構成する拡散部材ブロックと前記第２の層を構成する拡散部材ブロックとを異なる大きさに形成し、前記第１の層の各拡散部材ブロックの突き合わせ位置と前記第２の層の各拡散部材ブロックの突き合わせ位置とが重ならないようにしてある。また、本発明は、前記第２の層を構成する拡散部材ブロックと前記第３の層を構成する拡散部材ブロックとを異なる大きさに形成し、前記第２の層の各拡散部材ブロックの突き合わせ位置と前記第３の層の各拡散部材ブロックの突き合わせ位置が重ならないようにしてある。

【００１３】請求項７の発明は、請求項１～６のいずれかの拡散部材組立体において、前記光源を棒状の蛍光ランプとし、前記凹部を前記蛍光ランプの長手方向に沿って線状に形成してなることを特徴としている。

【００１４】請求項８の発明は、請求項１～７のいずれかの拡散部材組立体において、前記凹部の全てに、前記拡散部材ブロックと異なる屈折率の光透過性物質を充填してなることを特徴としている。

【００１５】請求項９の発明は、請求項１～７のいずれかの拡散部材組立体において、前記多数の凹部の一部に、前記拡散部材ブロックと異なる屈折率の光透過性物質を充填してなることを特徴としている。

【００１６】請求項１０の発明に係る面光源装置は、請求項１～９のいずれかに記載の拡散部材組立体と、この拡散部材組立体の裏面側に位置して、前記光源からの光を前記拡散部材組立体の裏面側に反射する反射部材と、を備えたことを特徴としている。

【００１７】請求項１１の発明は、請求項１０に係る面光源装置において、前記拡散部材組立体の出射面側に少なくとも一枚の拡散シートを配置してなることを特徴としている。

【００１８】請求項１２の発明に係る画像表示装置は、請求項１０又は１１に記載の面光源装置と、この面光源装置によって照明される画像表示部と、を備えたことを特徴としている。

【００１９】

【発明の実施の形態】以下、本発明の実施の形態を図面に基づき詳述する。

【００２０】［第１の実施の形態］図１は、本発明の実施の形態に係る面光源装置の外観斜視図である。また、図２は、図１の面光源装置の分解斜視図である。また、図４は、図１のＡ－Ａ線に沿って切断して示す断面図である。

【００２１】（面光源装置及び画像表示装置の概略構成）これらの図に示すように、本実施の形態に係る面光源装置１は、拡散部材組立体２の裏面側（図１，図２及び図４の下面側）に複数の棒状の蛍光ランプ（光源）3.を所定の間隔で配置してあり、それらの蛍光ランプ３の下方側に反射部材４を配置してある。この反射部材４は、蛍光ランプ３からの光を拡散部材組立体２の裏面側に反射するようになっている。そして、拡散部材組立体２の出射面側（上方側）には拡散シート５を配置して、拡散部材組立体２から出射した光をその拡散シート５で拡散するようになっている。なお、図４に示すように、面光源装置１の拡散シート５の上に液晶表示パネル（画像表示部）６を重ねて配置することにより、その液晶表示パネル６を面光源装置１から出射した面状の光で照明する画像表示装置７が構成されるようになっている。

【００２２】（拡散部材組立体）拡散部材組立体は、第１の層８から第３の層１０までの３層構造である。このうち、第１の層８は、図３に示すように、四角形の板状体である６個の拡散部材ブロック８ａ～８ｆを組み合わせることにより、液晶表示パネル６の平面形状に対応するような四角板状に形成してある。すなわち、第１の層８は、拡散部材ブロック８ａ～８ｆを縦に２個並べ且つ横に３個並べ（２行３列の合計６個並べ）、各拡散部材ブロック８ａ～８ｆの側面を密接させることにより四角板状に形成してある。

【００２３】また、第２の層９は、図３に示すように、四角形の板状体である１５個の拡散部材ブロック９ａ～９ｏを組み合わせることにより、液晶表示パネル６の平面形状に対応するような四角板状に形成してある。すなわち、第２の層９は、拡散部材ブロック９ａ～９ｏを縦に３個並べ且つ横に５個並べ（３行５列の合計１５個並べ）、各拡散部材ブロック９ａ～９ｏの側面を密接させることにより四角板状に形成してある。そして、この第２の層９の各拡散部材ブロック９ａ～９ｏの突き合わせ位置は、第１の層８の各拡散部材ブロック８ａ～８ｆの突き合わせ位置に重ならないようになっている。

【００２４】また、第３の層１０は、四角形の板状体である２個の拡散部材ブロック１０ａ，１０ｂを組み合わせることにより、液晶表示パネル６の平面形状に対応するような四角板状に形成してある。すなわち、第３の層１０は、拡散部材ブロック１０ａ，１０ｂを横に２個並べ、両拡散部材ブロック１０ａ，１０ｂの側面を密接させることにより四角板状に形成してある。そして、この第３の層１０の両拡散部材ブロック１０ａ，１０ｂの突き合わせ位置は、第２の層９の各拡散部材ブロック９ａ～９ｏの突き合わせ位置に重ならないようになっている。

【００２５】ここで、第１の層８から第３の層１０までの各層の各拡散部材ブロック８ａ～８ｆ，９ａ～９ｏ，１０ａ～１０ｂは、光透過性に優れたアクリル樹脂（ＰＭＭＡ）やポリカーボネート（ＰＣ）、シクロオレフィン系樹脂等を射出成形することにより、所望の形状に形成してある。

【００２６】図５は、図４に示す拡散部材組立体２の部分的拡大図である。また、図６は、図５に示す拡散部材組立体２を第１の層８から第３の層１０までの各層に分解して示す部分的拡大図である。

【００２７】これらの図に示すように、第１の層８の拡散部材ブロック８ａ～８ｆの第２の層９の拡散部材ブロック９ａ～９ｏに対向する面には、断面略半円形状の第１の凹部１１を等間隔で多数形成してある。また、第２の層９の拡散部材ブロック９ａ～９ｏの第１の層８の拡散部材ブロック８ａ～８ｆに対向する面には、第１の層８の第１の凹部１１に対向する断面略半円形の第２の凹部１２を等間隔で多数形成してある。その結果、第１の層８の拡散部材ブロック８ａ～８ｆと第２の層９の拡散部材ブロック９ａ～９ｏとを重ねて密着させると、第１の凹部１１と第２の凹部１２とによって断面略円形の空孔部１３が形成されるようになっている。

【００２８】第２の層９の拡散部材ブロック９ａ～９ｏの第３の層１０の拡散部材ブロック１０ａ，１０ｂに対向する面には、断面略半円形の第３の凹部１４を前記第２の凹部１２間に位置するように且つ第２の凹部１２の形成ピッチと同一のピッチＰで多数形成してある。また、第３の層１０の拡散部材ブロック１０ａ，１０ｂの

第２の層９の拡散部材ブロック９ａ～９ｏに対向する面には、第２の層９の第３の凹部１４に対向する断面略半円形の第４の凹部１５を等間隔で多数形成してある。その結果、第２の層９の拡散部材ブロック９ａ～９ｏと第３の層１０の拡散部材ブロック１０ａ，１０ｂとを重ねて密着させると、第３の凹部１４と第４の凹部１５とによって断面略円形の空孔部１６が形成されるようになっている。なお、各凹部１１，１２，１４，１５間のピッチＰは、凹部１１，１２，１４，１５の半径をＲとすると、２Ｒ≦Ｐ≦４Ｒの範囲で決定することが好ましい。

【００２９】ここで、拡散部材組立体２の上方から（図４のＢ方向から）見た場合や、斜め方向（図４のＣ，Ｄ方向）から見た場合、第１の層８と第２の層９の重ね合わせ面にできる空孔部１３間に、第２の層９と第３の層１０の重ね合わせ面にできる空孔部１６が位置するようになっている（換言すれば、空孔部１６が空孔部１３に対して半ピッチずれている）。そして、この拡散部材組立体２は、空孔部１３，１６内に空気が存在しており、拡散部材ブロック（８ａ・・・１０ｂ）と空孔部１３，１６とで光の屈折率が大きく異なる（例えば、ＰＭＭＡの屈折率が約１．４９であり、ＰＣの屈折率が１．５９である）とともに、空孔部１３，１６の断面形状が略円形であるため、蛍光ランプ３からの光が拡散部材組立体２を透過する際に空孔部１３，１６で効果的に拡散される。すなわち、上方（図４のＢ方向）から拡散部材組立体２を見た場合はもちろんのこと、斜め上方（図４のＣ，Ｄ方向）から見た場合においても、蛍光ランプ３からの光が空孔部１３，１６で均一に拡散されているため、出射光の輝度が均一化し、出射光の明暗の差が生じにくい。

【００３０】なお、本実施の形態において、各層の隣り合う拡散部材ブロック（８ａ～８ｆ，９ａ～９ｏ，１０ａ～１０ｂ）同士を接着して一体化する場合には、拡散部材ブロック（８ａ・・・１０ｂ）と屈折率がほぼ同様の接着剤（例えば、エポキシ樹脂系接着剤）を使用することが望ましい。

【００３１】（反射部材）反射部材４は、図１～図２及び図４に示すように、光反射性に優れた白色のポリエチレンテレフタレート（ＰＥＴ）等の樹脂材料、又はステンレス鋼板等の金属板の内面に銀の蒸着層を形成したもの等で形成してあり、蛍光ランプ３からの光を導光板組立体２の裏面側に効果的に反射するようになっている。

【００３２】（拡散シート）拡散シート５は、図１～図２及び図４に示すように、光透過性に優れたＰＥＴシート等の表面を粗面化したり、また、その表面に光拡散性を有するインクで光拡散パターンを形成したり、また、その内部に光拡散物質を含有させて、拡散部材組立体２から出射する光を効果的に拡散する。その結果、拡散シート５の出射面方向から面光源装置１を見た場合、第１の層８から第３の層１０までの各層の拡散部材ブロック（８ａ～８ｆ，９ａ～９ｏ，１０ａ～１０ｂ）の突き合わせ部（第１の層８から第３の層１０までの分割部）が目立ちにくくなる。

【００３３】（本実施の形態の作用・効果）以上のような本実施の形態に係る面光源装置１は、蛍光ランプ３の光が直接又は反射部材４によって反射されて拡散部材組立体２の第１の層８の拡散部材ブロック８ａ～８ｆ下面から入射すると、その入射光が第１の層８の拡散部材ブロック８ａ～８ｆ内を伝播する過程において第１の層８と第２の層９の重ね合わせ面に形成された凹部１１，１２（空孔部１３）との界面で屈折作用を受ける。ここで、その空孔部１３の断面形状が略円形形状であり、しかも空孔部１３の内部に空気が存在し、空孔部１３の内部と第１及び第２の層８，９の拡散部材ブロック８ａ～９ｏとの光の屈折率が大きく相違するため、第１の層８の拡散部材ブロック８ａ～８ｆ内を伝播する光が均一に拡散される。

【００３４】そして、上述の第１の層８と第２の層９の重ね合わせ面に形成した空孔部１３で拡散されない光及び拡散された光が第２の層９の拡散部材ブロック９ａ～９ｏ内を伝播すると、第２の層９と第３の層１０の重ね合わせ面に形成された凹部１４，１５（空孔部１６）との界面で屈折作用を受ける。ここで、この第２の層９と第３の層１０の重ね合わせ面に形成した空孔部１６は、上述の第１の層８と第２の層９との間に形成した空孔部１３と同様であるため、第２の層９内を伝播する光がその空孔部１６で均一に拡散される。すなわち、第２の層９と第３の層１０との重ね合わせ面に形成した空孔部１６は、第１の層８と第２の層９の重ね合わせ面に形成した空孔部１３で拡散できなかった光を拡散することができる。尚、図１０に空孔部１３，１６との界面で屈折作用を受け拡散する光の代表的な光路を概念的に示す。

【００３５】したがって、拡散部材組立体２からの出射光は、出射面の法線方向（図４のＢ方向）はもちろんのこと、法線方向に対して斜めの方向（図４のＣ，Ｄ方向）においても均一化する。すなわち、本実施の形態の面光源装置１において、拡散部材組立体２からの出射光は、観察方向によって輝度むらが生じるようなことがなく、照明品質が向上する。

【００３６】そして、拡散部材組立体２から出射した光は、拡散シート５を通過し、液晶表示パネル６の照明光として利用される。ここで、各層の隣り合う拡散部材ブロックを十分に密着させることができず、その境界に沿って光学的な界面が存在するとスジ状の輝線が発生してしまう等の異常発光が観察されることがあるが、第１の層８の各拡散部材ブロック８ａ～８ｆの突き合わせ部で生じる異常発光が第２の層９，第３の層１０及び拡散シート５で拡散され、第２の層９の各拡散部材ブロック９ａ～９ｏの突き合わせ部で生じる異常発光が第３の層１０及び拡散シート５で拡散され、第３の層１０の拡散部

材ブロック１０ａ，１０ｂ同士の突き合わせ部で生じる異常発光が拡散シート５で拡散され、各拡散部材ブロック８ａ・・・１０ｂの突き合わせ部で生じる異常発光が目立たなくなる。その結果、本実施の形態に係る面光源装置１は、液晶表示パネル６を明るく均一な光で照明でき、液晶表示パネル６の表示が見やすくなる。

【００３７】また、本実施の形態に係る面光源装置１は、従来例のような遮光膜（遮光パターン）を形成する必要がないため、遮光膜で光が吸収されるようなことがなく、出射光輝度を高めることができる。

【００３８】また、本実施の形態に係る面光源装置１は、拡散部材組立体２を第１～第３の層８～１０に多層化し、各層８～１０を複数の拡散部材ブロック８ａ～８ｆ，９ａ～９ｏ，１０ａ～１０ｂに分割して構成してあるため、小さな拡散部材ブロック８ａ・・・１０ｂの組み合わせ個数を多くすることにより、拡散部材組立体２の出射光面積を容易に大きくすることができる。したがって、本実施の形態によれば、拡散部材ブロック８ａ・・・１０ｂを射出成形するための金型が小さくてすむと共に、液晶表示パネル６の大きさ（表示画面の大きさ）に関わらず拡散部材ブロック８ａ・・・１０ｂの射出成形用金型を共用できるため、製造設備の大型化をすることなく、大型画面用の面光源装置１を容易に製造することが可能になる。

【００３９】また、本実施の形態に係る面光源装置１は、拡散部材組立体２の空孔部１３，１６内が空気層であるため、全体重量の軽量化を図ることができる。

【００４０】また、本実施の形態に係る拡散部材組立体２は、各層８～１０が複数の拡散部材ブロック８ａ・・・１０ｂに分割されており、各拡散部材ブロック８ａ・・・１０ｂが小さくて射出成形し易いため、成形不良が生じにくく、製品の歩留り率がよい。

【００４１】［第２の実施の形態］図７は、本発明の第２の実施の形態に係る拡散部材組立体２の一部を拡大して示す側面図である。

【００４２】本実施の形態は、図７に示すように、断面略半円形の第１の凹部２０を第１の層８と第２の層９との重ね合わせ面のいずれか一方に多数形成し、また、断面略半円形の第２の凹部２１を第２の層９と第３の層１０との重ね合わせ面のいずれか一方に多数形成するものである。なお、第１の層８から第３の層１０の各層は、前述の第１の実施の形態と同様に複数の拡散部材ブロック８ａ・・・１０ｂを組み合わせて構成されるようになっている（図３参照）。

【００４３】すなわち、本実施の形態の第１例は、図７（ａ）に示すように、第１の凹部２０を第１の層８の第２の層９に対向する面に形成し、また、第２の凹部２１を第３の層１０の第２の層９に対向する面に形成するようになっており、しかも、第２の凹部２１が第１の凹部２０，２０の間に位置するようになっている（換言すれば、第２の凹部２１が第１の凹部２０に対して半ピッチずれている）。

【００４４】また、本実施の形態の第２例は、図７（ｂ）に示すように、第１の凹部２０を第２の層９の第１の層８に対向する面に形成し、また、第２の凹部２１を第２の層９の第３の層１０に対向する面に形成するようになっており、しかも、第２の凹部２１が第１の凹部２０，２０の間に位置するようになっている。

【００４５】また、本実施の形態の第３例は、図７（ｃ）に示すように、第１の凹部２０を第２の層９の第１の層８に対向する面に形成し、また、第２の凹部２１を第３の層１０の第２の層９に対向する面に形成するようになっており、しかも、第２の凹部２１が第１の凹部２０，２０の間に位置するようになっている。

【００４６】また、本実施の形態の第４例は、図７（ｄ）に示すように、第１の凹部２０を第１の層８の第２の層９に対向する面に形成し、また、第２の凹部２１を第２の層９の第３の層１０に対向する面に形成するようになっており、しかも、第２の凹部２１が第１の凹部２０，２０の間に位置するようになっている。

【００４７】このような構成の本実施の形態においても、蛍光ランプ３からの光を各凹部２０，２１によって拡散することができ、拡散部材組立体２の出射面から光を均一に出射することができるため、観察方向による出射光の輝度むらの発生を効果的に防止できる。

【００４８】また、本実施の形態においても、前述の第１の実施の形態と同様の効果を得ることができる。

【００４９】［第３の実施の形態］図８は、本発明の第３の実施の形態に係る拡散部材組立体２の一部を拡大して示す側面図である。

【００５０】本実施の形態は、拡散部材組立体２を第１の層８と第２の層９で構成し、これら第１の層８と第２の層９の重ね合わせ面の少なくとも一方に凹部２２を多数形成するようになっている。なお、本実施の形態の第１の層８及び第２の層９は、前述の各実施の形態と同様に複数の拡散部材ブロック８ａ～８ｆ，９ａ～９ｏを組み合わせて構成されるようになっている。

【００５１】すなわち、本実施の形態の第１例は、図８（ａ）に示すように、第１の層８と第２の層９の重ね合わせ面に凹部２２，２２を対向させて形成するようになっている。また、第２例は、図８（ｂ）に示すように、第１の層８の第２の層９に対向する面に凹部２２を多数形成するようになっている。また、第３例は、図８（ｃ）に示すように、第２の層９の第１の層８に対向する面に凹部２２を多数形成するようになっている。なお、これら第１～第３例の凹部２２は、滑らかな曲線で連続的に形成されており、隣り合う凹部２２，２２同士も滑らかな曲線で接続されるようになっている。そのため、凹部２２を形成する面の断面形状が略波形形状を呈している。

【００５２】また、第４例は、図８（ｄ）に示すように、第１の層８と第２の層９の各重ね合わせ面にそれぞれ断面略半円形の凹部２２，２２を多数形成するようになっており、第１の層８の凹部２２，２２間に第２の層９の凹部２２が位置するようになっている。

【００５３】このような本実施の形態に係る拡散部材組立体２も、蛍光ランプからの光を凹部２２で拡散することができ、観察方向による輝度むらの発生を効果的に防止することができる。

【００５４】なお、本実施の形態に係る拡散部材組立体２は、層の数が少ないため、面光源装置１及びこの面光源装置１を備えた画像表示装置７の薄型化・軽量化を図ることができる。

【００５５】［その他の変形例］上述の各実施の形態は、凹部１１～１２，１４～１５，２０～２２内に空気が存在する態様を例示しているが、これに限られず、凹部１１～１２，１４～１５，２０～２２内に拡散部材ブロック８ａ・・・１０ｂの屈折率と異なる屈折率の光透過性物質を充填するようにしてもよい。また、凹部１１～１２，１４～１５，２０～２２に充填する光透過性物質は、拡散部材ブロック８ａ・・・１０ｂと同種又は異種の材料にこれと異なる屈折率を有する微小粒子を混入分散させたものであってもよい。なお、光透過性物質は、凹部１１～１２，１４～１５，２０～２２の全てに充填してもよく、また、その一部に充填するようにしてもよい。

【００５６】また、上述の各実施の形態において、略半円形又は滑らかな曲線で連続的に形成された断面形状の凹部１１～１２，１４～１５，２０～２２を例示したが、これに限られず、光を拡散できる断面形状の凹部であればよく、断面略三角形の凹部やその他の断面形状の凹部でもよい。

【００５７】また、上述の各実施の形態は、拡散部材組立体２を３層又は２層で構成する態様を例示しているが、これに限られず、拡散部材組立体２を４層以上の多層構造体にしてもよい。

【００５８】また、上述の各実施の形態は、図９に示すように、凹部１１～１２，１４～１５，２０～２２を蛍光ランプの長手方向に沿って線状に形成する態様を例示するものであるが、これに限られず、例えば、凹部をドット状に多数形成する態様にしてもよい。

【００５９】また、上述の各実施の形態では凹部（空孔部）の形成ピッチを一定のものとしているが、裏面側に配置する光源との相対的な位置に応じて、その形成ピッチの粗密を変化させるようにしてもよい。

【００６０】

【発明の効果】以上のように、本発明は、裏面側に配置した光源からの光を拡散して出射する拡散部材組立体が多層構造体であり、各層の重ね合わせ面の少なくとも一方に形成した凹部で光を均一に拡散できるようになっているため、観察方向によって輝度むらが生じるのを効果的に抑えることができ、出射面の法線方向はもちろんのこと、出射面の法線方向に対して斜めの方向への出射光の輝度分布も均一化することができ、照明品質の向上を図ることができる。

【００６１】また、本発明は、拡散部材組立体の各層の重ね合わせ面の少なくとも一方に形成した凹部が光を拡散するため、従来例のような遮光パターンを拡散部材に形成する必要がなく、少なくとも遮光パターンによる光の吸収が無い分だけ出射光輝度を高めることができる。

【００６２】したがって、本発明に係る拡散部材組立体を備えた面光源装置は、画像表示部を照明する照明光が均一化すると共に高輝度化する。その結果、このような面光源装置を備えた画像表示装置は、画像表示部による表示画像が明るくて見やすくなる。

【図面の簡単な説明】

【図１】本発明の第１の実施の形態に係る面光源装置の外観斜視図である。

【図２】図１の面光源装置を分解して示す斜視図である。

【図３】本発明の第１の実施の形態に係る拡散部材組立体を分解して示す平面図である。

【図４】図１のＡ－Ａ線に沿って切断して示す断面図である。

【図５】図４に示す拡散部材組立体の部分的拡大図である。

【図６】図５に示す拡散部材組立体を分解して示す部分的拡大図である。

【図７】本発明の第２の実施の形態に係る拡散部材組立体の部分的拡大図である。

【図８】本発明の第３の実施の形態に係る拡散部材組立体の部分的拡大図である。

【図９】拡散部材組立体の各層に形成する凹部の形状を示す斜視図である。

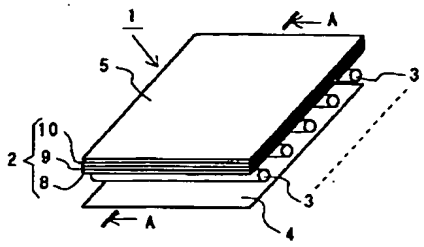
【図１０】空孔部との界面で屈折作用を受けて拡散する光の代表的な光路を概念的に示す図である。

【図１１】従来の面光源装置の一部を拡大して示す側面図である。

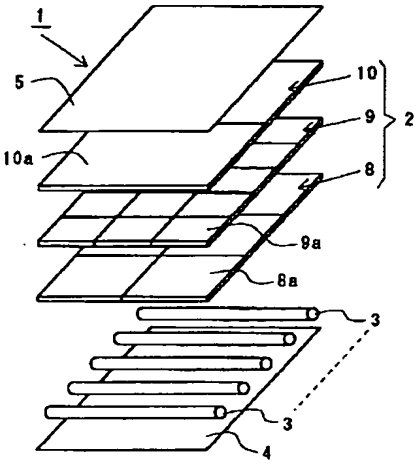
【符号の説明】

１……面光源装置、２……拡散部材組立体、３……蛍光ランプ（光源）、４……反射部材、５……拡散シート、６……液晶表示パネル（画像表示部）、７……画像表示装置、８……第１の層、９……第２の層、１０……第３の層、８ａ～８ｆ，９ａ～９ｏ，１０ａ～１０ｂ……拡散部材ブロック、１１，１２，１４，１５，２０，２１，２２……凹部

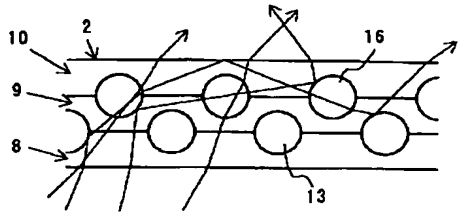
【図１】



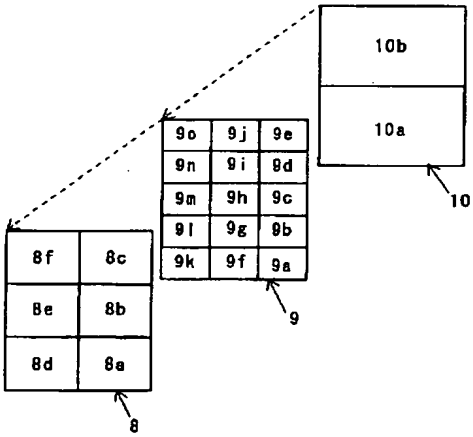
【図２】



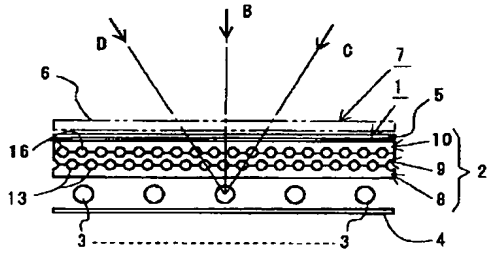
【図１０】



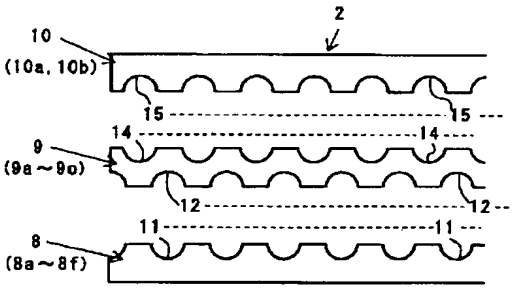
【図３】



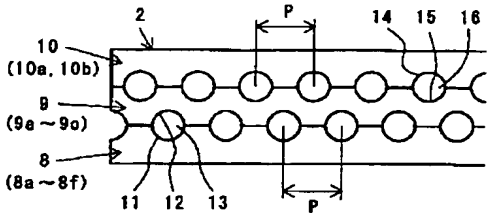
【図４】



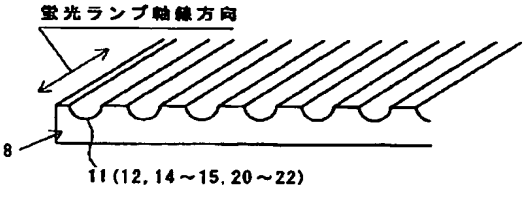
【図６】



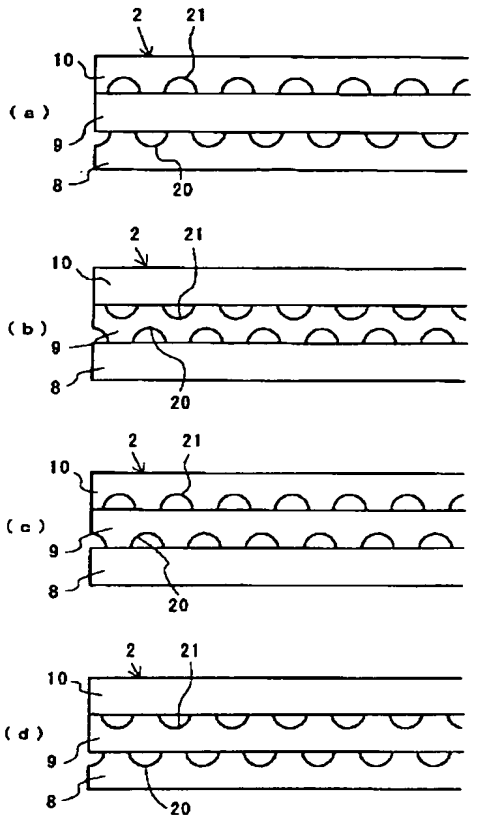
【図５】



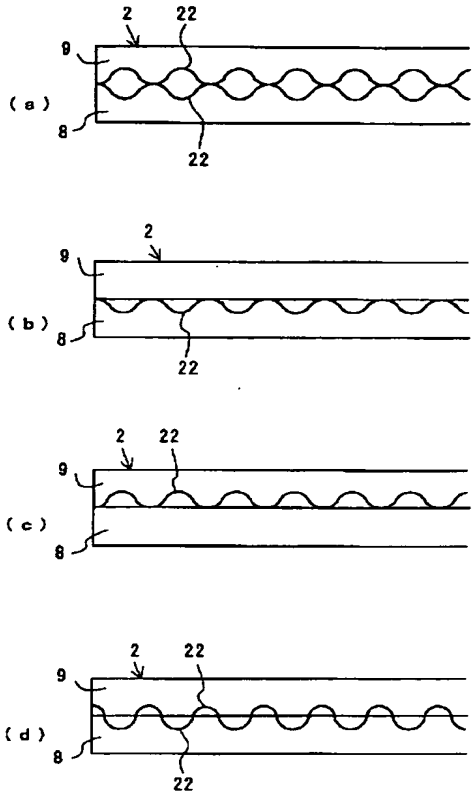
【図９】



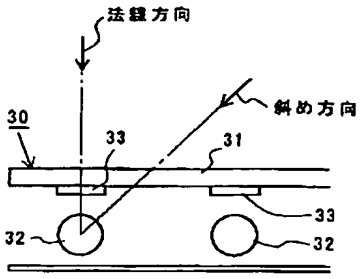
【図７】



【図８】



【図１１】



フロントページの続き

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